

REMARKS**I. Introduction**

In response to the Office Action dated March 3, 2004, Applicants have canceled claims 15-17, 19-23 and 27, without prejudice or disclaimer. Thus, the pending rejections to claims 15-17, 19-23 and 27 are moot. Applicants have amended claim 11 so as to further clarify the claimed subject matter. Support for this amendment can be found, for example, on page 10, lines 5-20. No new matter has been added.

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection of Claims 11 and 26 under 35 U.S.C. § 102

Claims 11 and 26 are rejected under 35 U.S.C. § 102 as being anticipated by USP No. 4,830,984 to Purdes. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 11, as amended, relates to an epitaxial growth method comprising: growing an epitaxial layer on a layered substrate which exhibits bowing in a manner so as to reduce the bowing, wherein the layered substrate has at least two layers and, wherein at least two of the layers have different thermal coefficients and have the same growth temperature.

In accordance with one embodiment of the present invention, silicon layer 212 is grown on one side of the sapphire substrate 210, for example, by chemical vapor deposition at around 1000° C, while an alloy-based device layer 214 is grown on the other side of the sapphire substrate 210 by metal organic chemical vapor deposition at around 1000° C.

Turning to the cited prior art, Purdes discloses that the substrate with the layer of titanium silicide (i.e. tensioning material 22) is heated to a temperature of about 1000° C, and maintained at that temperature for sufficient time for the titanium silicide to stabilize. Next, the substrate is cooled to 650° C, and a layer of gallium arsenide about 3 microns thick is grown on the first surface of the silicon substrate (See, col. 5, lines 12-39). In other words, Purdes discloses growing two layers at different temperatures so as to obtain a planar or essentially planar surface on the gallium arsenide layer. Thus, at a minimum, Purdes does not disclose or suggest that the at least two of the layers have the same growth temperature.

As anticipation under 35 U.S.C. § 102 requires that each element of the claim in issue be found, either expressly described or under principles of inherency, in a single prior art reference, *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 USPQ 781 (Fed. Cir. 1983), and at a minimum, Purdes fails to disclose the foregoing claim elements, it is clear that Purdes does not anticipate claim 11 and any of the claims dependent thereon within the meaning of 35 U.S.C. § 102.

III. The Rejection of Claims 11 and 26 under 35 U.S.C. § 102

Claims 11 and 26 are rejected under 35 U.S.C. § 102 as being anticipated by USP No. 5,562,770 to Chen. Applicants respectfully traverse this rejection for at least the following reasons.

As discussed above, claim 11, as amended, relates to an epitaxial growth method comprising: growing an epitaxial layer on a layered substrate which exhibits bowing in a manner so as to reduce the bowing and, wherein the layered substrate has at least two

layers, wherein at least two of the layers have different thermal coefficients and have the same growth temperature.

In accordance with one embodiment of the present invention, silicon layer 212 is grown on one side of the sapphire substrate 210 such as by chemical vapor deposition at around 1000° C, while an alloy-based device layer 214 is grown on the other side of the sapphire substrate 210 by metal organic chemical vapor deposition at around 1000° C.

Turning to the cited prior art, Chen discloses a method of imparting a convex curvature to the substrate by removing layers of thin film 160 from or adding layers of thin film to the back side of the substrate 140 so as to reduce the dislocation density in the device layer 150. However, nowhere does Chen disclose, suggest or mention any growth temperature, let alone suggest that at least two of the layers have the same growth temperature. Thus, at a minimum, Chen does not disclose or suggest that the two layers have the same growth temperature.

As anticipation under 35 U.S.C. § 102 requires that each element of the claim in issue be found, either expressly described or under principles of inherency, in a single prior art reference, *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 USPQ 781 (Fed. Cir. 1983), and at a minimum, Chen fails to disclose the foregoing claim elements, it is clear that Chen does not anticipate claim 11 and any of the claims dependent thereon within the meaning of 35 U.S.C. § 102.

IV. **The Rejection of Claims 11 and 26 under 35 U.S.C. § 103**

Claims 11, 13, 14 and 24-26 are rejected under 35 U.S.C. § 103 as being unpatentable over USP No. 6,086,673 to Molnar in view of Purdes or Chen. Applicants respectfully traverse this rejection for at least the following reasons.

The Examiner asserts that Molnar is silent to growing an epitaxial layer on a layered substrate, and relies upon Purdes or Chen to cure these deficiencies. The Examiner further relies on the inherency theory to disclose the thermal coefficients of the substrate materials and the layered substrate exhibiting bowing as recited by the rejected claims. This rejection is traversed.

Combination Of Prior Art Does Not Disclose All Claim Elements

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the ***claimed invention*** where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *Ecolchem Inc. v. Southern California Edison Co.*, 227 F.3rd 1361, 56 U.S.P.Q.2d (BNA) 1065 (Fed. Cir. 2000); *In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d (BNA) 1614, 1617 (Fed. Cir. 1999); *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 U.S.P.Q.2d 1941 (Fed. Cir. 1992). See also **M.P.E.P § 2143.01**.

The Examiner admits that “Molnar is silent to the layered substrate exhibiting bowing,” but alleges that “this is inherent to Molnar because Molnar discloses a layered substrate of SiC and sapphire.” However, as discussed during the personal interview dated July 23, 2003, merely because Molnar discloses similar materials does NOT necessitate that the layered substrate would exhibit bowing. For example, in order to exhibit bowing, the two layers forming the layered substrate of Molnar would need to be bonded together via heating at sufficient high temperatures and subsequent cooling.

Molnar, however, is completely silent as to the process for manufacturing the layered substrate.

As such, it is quite possible that the two layers of the layered substrate disclosed by Molnar are coupled together using adhesive without heating so as to NOT exhibit bowing. Further, the layered substrate may not be cooled after manufacture thereof so as to maintain the same temperature as during epitaxial growth, so that the epitaxial layers are not grown on a bowed layered substrate (i.e., layered substrate not cooled before growing epitaxial layer thereon, whereas cooling would be necessary to allow the different thermal coefficients within the layered substrate to cause bowing; *see* page 10, lines 11-13 of Applicant's specification). As is well known in patent prosecution, "inherency may not be established by probabilities or possibilities" (see *Scaltech Inc. v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999)).

Molnar is silent to bowing, let alone the needed parameters to reduce the bowing. Only Applicants have considered the bowing problem and determined a method of fabrication which enables a reduction in bowing. In fact, Molnar discloses a layered substrate simply as a viable option rather than a preferred embodiment, whereas the present invention provides a layered substrate for purposely creating an initial bowing which can then be reduced by growing epitaxial layers which counteract the initial bowing so that the **resulting** structure is flattened.

Further, claim 11, as amended, recites that two of the layers have the same growth temperature. In accordance with one embodiment of the present invention, silicon layer 212 is grown on one side of the sapphire substrate 210 such as by chemical vapor deposition at around 1000° C, while an alloy-based device layer 214 is grown on the

other side of the sapphire substrate 210 by metal organic chemical vapor deposition at around 1000° C.

In contrast, Molnar merely discloses a growth temperature of 800-1250° C for GaN deposition, and cooling the substrate after deposition at a rate of 1° C/min to 200° C/min under a NH₃ atmosphere, as asserted by the Examiner in the pending Office Action. However, nowhere does the combination of Molnar and Purdes or Chen disclose or suggest that the at least two of the alleged layers have the same growth temperature. Thus, at a minimum, the combination of Molnar and Purdes or Chen does not disclose or suggest that the two layers have the same growth temperature.

There Is No Motivation To Make The Proposed Combination Of Prior Art

In order to establish the requisite motivation, the Examiner must point to a **source** in the applied prior art for **each** claim limitation and a **source** in the applied prior art for the requisite **motivational** element. *Smiths Industries Medical System v. Vital Signs Inc.*, 183 F.3d 1347, 51 USPQ2d 1415 (Fed. Cir. 1999). More to the point, the Examiner is required to make a “thorough and searching” factual inquiry and, based upon that factual inquiry, explain **why** one having ordinary skill in the art would be realistically impelled to modify particular prior art, in this case the **particular** process for producing high quality III-V nitride substrates of Molnar, to arrive at the claimed invention. *In re Lee*, 237 F.3d 1338, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002). Such a factual inquiry requires clear and particular factual findings as to a specific understanding or specific technological principle which would have realistically impelled one having ordinary skill in the art to modify the **particular** process for producing high quality III-V

nitride substrates to arrive at the claimed invention. *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 57 USPQ2d 1161 (Fed. Cir. 2000); *Ecolochem Inc. v. Southern California Edison, Co.*, 227 F.3d 1361, 56 USPQ2d 1065 (Fed. Cir. 2000); *In re Kotzab*, 217 F.3d 1365, 55 USPQ 1313 (Fed. Cir. 2000); *In re Dembiczak*, 175 F.3d 994, 50 USPQ2d 1614 (Fed. Cir. 1999). Merely identifying wherein features of a claimed invention are perceived to reside in disparate references does not establish the requisite motivation. *In re Kotzab, supra*; *Grain Processing Corp. v. American-Maize Products Co.*, 840 F.2d 902, 5 USPQ2d 1788 (Fed. Cir. 1988). Rather, a **specific reason** must be offered based upon **facts** to support the asserted motivation--not generalizations. *Ecolochem Inc. v. Southern California Edison, Co. supra*; *In re Rouffet*, 149 F.3d 1350, 47 USPQ2d 1453 (Fed. Cir. 1998).

In applying the above legal tenets to the exigencies of this case, Applicants submit that the requisite motivation element has **not** been established. Specifically, the Examiner has not actually explained **why** based on **facts**, one having ordinary skill in the art would somehow have proceeded **against** the specific teachings of Molnar by growing an epitaxial layer on a layered substrate which exhibits bowing so as to reduce the bowing, wherein the layered substrate has at least two layers, wherein at least two of the layers have different thermal coefficients and have the same growth temperature.

In particular, Molnar discloses forming a GaN layer on a ZnO layer, rather than on a sapphire substrate (see, example 1 and 3). In this regard, Applicants note that Molnar discloses forming a ZnO pretreatment layer on a growth substrate, exposing the formed ZnO pretreatment layer to a gaseous environment that is reactive with the ZnO pretreatment layer, and epitaxially growing a nitride layer on the substrate. Thus, Molnar

expressly discloses a method for producing a nitride layer so as to improve the density of dislocations in the layer, and enable the production of high quality nitride layers. The Examiner's assertion that the layered substrate and at least two of the layers as recited in claim 11 are similar to those taught by Molnar is not supported by the disclosure of Molnar, since Molnar's process requires a ZnO pretreatment layer, which is not a semiconductor, be deposited between the substrate and the GaN layer.

Hence, the Examiner's conclusion of obviousness is without any evidentiary foundation because Molnar's structure requires a pretreatment layer be deposited between the substrate and the GaN layer, whereas Purdes or Chen does not require any pretreatment layer, such as ZnO, be deposited on the substrate. As such, since the structure disclosed in Molnar differs from the structure of Purdes or Chen, the claimed method is fundamentally different from that disclosed by the combination of Molnar and Purdes or Chen. It is respectfully submitted that one of ordinary skill in the art would NOT have been realistically motivated to modify the process for producing nitride substrates of Molnar with the method for heteroepitaxial growth using tensioning layer on rear substrate surface as disclosed by Purdes or the manufacturing process for low dislocation defects as disclosed by Chen.

Additionally, nowhere does Molnar disclose or suggest any parameter such as the materials, relative thermal coefficients, relative thicknesses or processing parameters for counteracting any initial bowing to prevent the resulting structure from being warped. Even in the layered substrate of Molnar, assuming *arguendo* such layered substrate has an initial bowing, there is no suggestion or motivation from the cited prior art for controlling the required parameters so that epitaxial growth will reduce the initial

bowing. Indeed, Molnar is silent as to the manufacturing process forming the layered substrate and parameters related to reducing the bowing, such as the respective thicknesses. Hence, it is impossible to determine the amount of an initial bowing assuming *arguendo* there is bowing, let alone determine whether growing the epitaxial layer reduces the initial bowing.

Moreover, with regard to Purdes, while Purdes may have disclosed forming a gallium arsenide on the surface of the silicon substrate at a certain temperature, Purdes is silent to growing the at least two of the layers under the same growth temperature, as recited by amended claim 11. Chen does not appear to even mention or recognize any growth temperature, let alone suggest that at least two of the layers have the same growth temperature.

Thus, for at least the foregoing reasons, it is respectfully submitted that the combination of Molnar and Purdes or Chen is improper, and therefore the rejection must be withdrawn.

V. **All Dependent Claims Are Allowable Because The Independent Claims From Which They Depend Are Allowable**

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1, 5 and 19 are patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also in condition for allowance.

For all of the foregoing reasons, it is submitted that claim 11 is patentable over the cited prior art. Accordingly, it is respectfully requested that the rejections of claims 11 and 26 under 35 U.S.C. § 102, and claims 11-14 and 24-26 under 35 U.S.C. § 103 be withdrawn.

VI. Conclusion

Accordingly, it is urged that the application is in condition for allowance, an indication of which is respectfully solicited.

If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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